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Delphinium, an attempt to distinguish the North American Species.

ASA GRAY.

This *essay* at an arrangement of our species of Delphinium is submitted to the botanists of the United States in the hope of eliciting, during the ensuing spring and summer, some observations on the living plants and such collections of specimens with their roots, fruit, and seed as may either confirm or invalidate the characters which I have endeavored to turn to account.

I make no reference to the naturalized species, of the section *Consolida;* nor to the two scarlet-flowered species of California, D. nudicaule and D. cardinale (§ *Phœnicodelphis*), except to say that it would be well to verify the fact noted by that most experienced seed-raiser, Mr. William Thompson, that while D. nudicaule germinates (after the manner of D. tricorne) with prolonged connate cotyledon-petioles and hypogæous plumule, the nearly allied D. cardinale does not.

In our species of the *Delphiniastrum* section, I think good use may be made of the seeds and of the root, although most of our species have the same type of seed.

1. Seed-coat close, smooth: root fasciculate-tuberous. D. TRICORNE.

2. Seed-coat cellular, more or less loose and rugulose: stem scapiform from thickish branching roots.

Leaves well dissected: raceme many-flowered. D. SCAPOSUM.

Leaves merely 3-cleft: raceme few-flowered. D. VILIGINOSUM.

3. Seed-coat loose, cellular, becoming transversely rugose-squamellate: fascicled roots long: stem leafy. D. AZUREUM.

4. Seeds with loose cellular coat either arilliform or when dry merely scarious-margined or winged at the angles, not at all squamelliferous: more or less leafy-stemmed.

*Fasciculate roots elongating, not at all tuberiferous.

+ Stem strict, tall or robust, many-leaved: raceme many-flowered: pedicels seldom longer than the flower or fruit, ascending or erect: follicles erect or nearly so, short-oblong.

Alleghany species, slender-stemmed: small flowers canescent-puberulent. D. EXALTATUM.

Californian, stout: sordid flowers villous. D. CALIFORNICUM.

Rocky Mountains to Oregon, etc.: flowers glabrous, canescent puberulent, or barely pubescent outside. D. SCOPULORUM.

+ + Stem lax, several–few-leaved: pedicels of loose raceme spreading or ascending, mostly long: follicles elongated cylindraceous, often diverging at maturity: flowers pretty large.

Stems 2 to 6 feet high: leaves mostly ample, the lobes acute: follicles recurving in age. D. TROLLIIFOLIUM.

Stems a span to a foot high: lobes of the small leaves obtuse, mostly linear. D. BICOLOR.

+ + + Stem strictly erect, with few or sparse leaves, a foot or two high, bearing a virgate or narrow raceme, with ascending pedicels, at least the upper not longer than the spur: follicles oblong, not over half an inch in length, not recurving.

Very glabrous, a foot or two high, robust: leaves thickish: sepals half an inch long, little surpassing the petals. D. ANDERSONI.

Puberulent or glabrous, 1 to 3 feet high: leaves not thick; divisions or lobes few and linear: roots comparatively long and slender.

Raceme a span to a foot long: sepals oval, over half inch long, much surpassing the petals, fully as long as the spur. D. PARRYI.

Raceme and flowers smaller: sepals oblong, 3 or 4 lines long, hardly surpassing the petals, shorter than the spur. D. PARISHII.

* * Fasciculate roots short and thickening, but not tuberiform: herbage puberulent or below hirsute: stem strict, a foot or two high: leaves not large: raceme spiciform or narrow: pedicels short, except some lower ones, ascending or erect: follicles oval or short oblong, erect, puberulent.

Raceme virgate, usually elongated and many-flowered: sepals oval, 4 or 5 lines long, hardly longer than petals or spur. D. HESPERRIUM.

Raceme of few to several large flowers: sepals orbicular-obovate or oval, 5 to 9 lines long, much surpassing the petals: follicles turgid. D. VARIEGATUM.

* * * Fasciculate-tuberous or grumous roots, *i. e.* a cluster of globular or oblong testiculate or sometimes palmate tubercles, bearing only fibrous rootlets.

+ Raceme spiciform and virgate, many-flowered, with erect or appressed pedicels shorter than the spur: stems strict.

Tall, somewhat velvety-pubescent: calyx externally pubescent. D. SIMPLEX.

Lower, glabrous or inflorescence puberulent: leaves thickish. D. DISTICHUM.

+ + Raceme loose, few-many-flowered: pedicels spreading or ascending, comparatively long, never appressed,

Long and lax, lower often 2 inches long: leaf lobes all narrow: follicles oblong-cylindraceous, half to three-fourths inch long, at maturity almost always widely recurving: flowers large and not numerous. D. MENZIESII.

An inch or less long, rarely longer: follicles oblong, hardly over half inch long or shorter, mostly erect: herbage glabrous or nearly so.

Spur not longer than sepals, thickish: lower leaves with broad or broadish divisions. D. DECORUM.

Spur longer than sepals, slender.

Low, or slender and few-flowered: leaf-lobes all or mostly linear: sepals 3 or 4 lines long: root-tubercles disposed to be fusiform. D. PAUCIFLORUM.

Strict, 2 feet high, with rather many-flowered raceme: leaf-lobes lanceolate: petals all bright blue. D. NUTTALLII.

Such a key is far from satisfactory.

D. tricorne Michx. does not extend further west than Minnesota and Arkansas.

D. scaposum Greene belongs to S. Utah and Arizona, in the latter territory accompanying D. azureum. More fruit of it is desirable.

D. uliginosum Curran seems to be a near relative of the preceding. It is imperfectly known, only at one station, in Lake Co., California.

D. azureum Michx., with its var. **vimineum,** extends from Saskatchewan and from N. Carolina to Arizona and Mexico. The seeds should well distinguish it.

D. exaltatum Ait. is our most eastern species and can not be confounded.

D. Californicum Torr. & Gray seems also quite peculiar, and is restricted to the Californian coast district.

D. scopulorum Gray I take to be a collective species, of the Rocky Mountains and northwestward, to the type of which I am constrained to annex the following varieties:

Var. **stachydeum.** A form with narrow leaf-lobes and strict stem (3 to 7 feet high), upper part of this with the long and dense spiciform raceme and outside of flower cinereous-puberulent.—Interior of Oregon, *Cusick*. New Mexico and Arizona, *Pringle*.

Var. **glaucum.** Like the other broader-leaved forms, sometimes glaucous, even the pedicels glabrous or only obscurely glandular-puberulent, and follicles glabrous.—*D. glaucum* Watson. Sierra Nevada, California, to Washington Territory, and even to the Yukon River. Connects with

Var. **subalpinum.** A foot to a yard or more high, with shorter raceme of larger and deeper-colored flowers, the inflorescence and even upper part of stem viscidly pubescent or villous, and follicles glabrous.—This is *D. elatum* Gray in Am. Jour. Sci., *D. occidentale* Watson, and is the analogue of *D. alpinum* of Europe. It occurs through the higher mountains of Colorado to those of E. Oregon.

D. trolliifolium Gray occurs on the Columbia River, below the Dalles, and in N. W. California, and is evidently a species of woodland or shade.

D. bicolor Nutt., a low species of the higher Rocky Mountains, and of those of E. Oregon, etc., with the inflorescence and flowers somewhat of D. Menziesii, proves to have deep and long (instead of tuberiferous) roots. It is *D. Menziesii* var. *Utahense* Watson, Bot. King. Exp.

D. Andersonii is *D. Menziesii* Watson l. c., as to Nevada plant, and mainly *D. decorum* var. *Nevadense* of the Botany of California. It belongs to the mountains of W. Nevada and the adjacent Sierra Nevada. More specimens in fruit are desirable.

D. Parryi is founded on specimens collected in San Bernardino Co., California, by Parry in 1850, Parry and Lemmon in 1876, and by Parish: also apparently the same collected near Santa Barbara by Brewer.

D. Parishii is a rather low and rigid-stemmed species, much smaller-flowered than the preceding, collected at Agua Caliente, on the southeastern borders of California, by Parish, and in adjacent Lower California by Orcutt.

D. hesperium is a common Californian species, which has passed for *D. simplex* and for Californian *D. azureum*. It appears to abound from Mariposa Co. and from Monterey northward, and it reaches W. Oregon. The roots of this and the next species are intermediate in character between the merely fasciculate and the tuberiform types, but rather of the former.

D. variegatum Torr. & Gray is very well marked in character, and is one of the most showy species. Bentham, in Pl. Hartw. 295, took it for *D. decorum*, but wrongly. We know it only in California, from Monterey to the Upper Sacramento Valley.

The remaining species have genuine grumous or tuberiform roots, although, as to

D. simplex Dougl., this is only an inference; for the roots of Douglas' plant, and of Spalding's from the same district (W. Idaho), which accord in character, are wanting in the specimens. But the plant comes near to the following, which has commonly been taken for it. Further knowledge of this species is much desired.

D. distichum Geyer in Hook. Lond. Jour. Bot. vi. 67. *D. azureum* Torr. in Bot. Wilkes' Exped. Common on the low prairies of E. Oregon and Washington Territory, and extending to Montana.

D. Menziesii DC. Chiefly near the coast, Brit. Columbia to Oregon and northern part of California. There are puzzling specimens, but it appears to be the only grumose-rooted species with pretty large and slender peduncled flowers, succeeded by long and narrow divergently recurved follicles. Yet sometimes these seem to remain erect.

D. decorum Fisch. & Meyer. This is a low and lax

species of the western part of California, extending eastward to the Sierra Nevada, of very variable foliage, but comparatively broad-leaved. Indeed the rounded lower leaves are sometimes barely 3-lobed, and the divisions commonly round-obovate or cuneiform. The typical form (the plant raised in the St. Petersburgh garden, from seeds gathered at the Ross Colony—of which an original has been obligingly sent me for identification) has flowers as large as those of *D. Menziesii*. Other specimens agree with this; but not rarely, both in the northern and southern districts, it is much smaller-flowered, and passes freely into

Var. **patens,** the *D. patens* Benth. Pl. Hartw. This is a common form, with narrow leaf-lobes, and a narrower raceme of rather small flowers, the pedicels in fruit ascending. It would be taken for a quite distinct species, except for the intermediate forms.

D. pauciflorum Nutt. The type of this species occurs in the Rocky Mountains, from Wyoming and adjacent parts of Colorado to Idaho, and a slender form reaches the eastern borders of Washington Territory, and also California, where

Var. **depauperatum,** taken to be *D. depauperatum* Nutt. in Torr. & Gray, having broader leaf-lobes, may really be only an attenuate form of *D. decorum* var. *patens*. Additional materials and well formed fruit are wanted.

D. Nuttallii. So named because in our herbarium it is "D. simplex" of Nuttall. It is a moderately tall species, with grumose root, apparently quite distinct in character, occurring in low grounds along and near the Columbia River, above the Dalles, where it has been of late abundantly collected by Howell, Henderson, Suksdorf, etc. Nuttall's specimen is ticketed "Columbia Plains."

On the causes of the variations in the contents of sucrose in Sorghum saccharatum.

HARVEY W. WILEY.

For some years I have been investigating the Sorghum saccharatum in respect of its adaptability to the production of sugar.

During this time many difficulties have been encountered and these troubles have all been overcome with one excep-

tion. The chief obstacles to successful sugar making have been, *first*, unfavorable climatic conditions; *second*, imperfect methods of extracting the sugar; *third*, improper treatment of the extracted juice; *fourth*, variations and rapid changes in the sucrose of the juice. All of these problems have been successfully solved save the last. It is proper to say, however, that certain methods of cultivation and certain methods of selecting seeds tend to produce maximum contents of sucrose in the cane and these methods are not yet fully developed. A proper conception of the variations to which the sucrose in sorghum is obnoxious can not be had unless we study briefly the method of its formation, how it is stored and the physiological functions in which it takes part.

Vegetable physiologists have taught us that a carbohydrate can be formed by a certain retrogressive change in protoplasm, by which the cell envelope, in other words cellulose, is produced. The carbohydrates which appear in the embryo of a plant are developed at the expense of the stores of material in the seed. After the appearance of the chlorophyll cells in the plant the production of carbohydrates takes place with their aid, CO_2 being absorbed from the air and free oxygen being eliminated.

It would be easy to explain the production of carbohydrates by supposing that the chlorophyll cell exerted a reducing influence[1] on the CO_2 which, with the assimilation of water, produced, for instance, starch by the formula $6CO_2+5H_2O=C_6H_{10}O_5+O_{12}$. In the vast majority of plants it is found, in corroboration of this supposition, that the volume of the oxygen set free is sensibly the same as the carbonic dioxide absorbed. The carbohydrate which is generally formed in the chlorophyll cells is starch. This starch is removed from the leaf, and it is supposed that the carbohydrates which are formed in all parts of the plant are derived from this original substance.

In point of fact, however, the production of organic matter in a plant does not probably take place in the simple manner above described. It is more likely that the presence of a nitrogenous body is necessary and this proteid itself is the active principle of the production of new organic matter, by a certain decomposition it suffers, with the help of carbonic dioxide and water. Nor is it by any means certain that

[1]It has lately been stated that this reduction is due to the action of electricity on the leaf—producing hydrogen—and this hydrogen is the active principle in the reduction of he carbonic dioxide. This statement appears to be purely theoretical.

starch is the only organic matter formed by the chlorophyll cells; in fact, it is known that oil is often the product of this constructive and destructive metabolism.

But it seems reasonable to suppose that the different sugars are as likely to be formed in the leaf of the plant as starch.[2] When we remember how easily starch is detected in most minute quantities and how easily sugar is missed even when present in much larger quantities, we do not wonder that vegetable physiologists have supposed that starch is the first carbohydrate formed in the leaf and that all the others are derived therefrom. The explanation which is made of the translation of the starch from the point of its formation to the localities where it is stored is as follows:

Take, for instance, the formation of starch in the germ of cereals. We are taught that the starch first formed in the leaves is changed into sugar and in this soluble state carried through the plant until it reaches the seed. This sugar, reaching the point where the seed is forming, is changed to starch again by the amyloplast.

Let us subject this theory of the translation of starch to a brief examination. There are two only known methods by which starch can be converted into sugar, *viz.*: *first*, by the action of certain acids, and *second*, by the action of certain ferments. The conversion of starch into sugar by acids even at a high temperature and with the stronger acids is very slow. It is simply incredible that such a conversion can take place at the ordinary temperature in the leaf of a plant and by reason of the action of the extremely dilute weak vegetable acids which the leaf contains. In the same way it must be conceded that the opportunity for the action of a ferment in the leaf is extremely limited.[3] Such action requires time and much more favorable conditions than can be found in the living leaf. In any case if sugar be formed from starch in either of the ways indicated it could not be sucrose.

In fact the reducing sugar which is found in plants is seldom starch sugar, *i. e.* maltose or dextrose. This appears to be a fact which the vegetable physiologists have entirely ignored. The sugars of plants which reduce an alkaline copper solution are either derived from sucrose by inversion

[2]Meyer (*Botanische Zeitung*, 41, Nos. 5, 6, 7, 8) has lately shown that the leaf of the plant is incapable of forming starch out of sucrose, lævulose, etc., and calls especial attention to the fact that starch may not be the original substance formed.

[3]The ferment which acts on the starch has been studied by Brasse and Schimper (*Bied. Centralblatt*, vol. 14, p. 169, vol. 15, pp. 310 and 473). It is called *amylase*.

or more probably are of independent formation. If they were derived from starch they would show dextro- if from sucrose, lævo-gyration. In point of fact they often show neither, as I long ago pointed out when in view of this optical inactivity I proposed for them the name of anoptose. When they do show rotation, however, it is left-handed.

It seems to me that there is one fact that the physiologists forget, *viz.*, that starch is not always insoluble. In my examinations of sorghum juices I have never failed to find soluble starch when I looked for it. The existence of bodies when first formed in the soluble state, which when once made solid become insoluble, is not unknown. Certain forms of silica are illustrations of this. It seems much more reasonable to suppose that in the case of the sorghum for instance the starch which appears in the seed is partly transferred directly from the soluble nascent state to the seat of its final deposition. This, indeed, is hardly a theory in the light of the fact mentioned above: that the sap of the plant always contains soluble starch.

Led by the commonly accepted theory that the starch in the grain of cereals, etc., was formed from sugar, a few years ago some experiments were made to increase the sucrose in sorghum by cutting away the seed heads as they appeared and thus preventing the formation of starch. Two or three analyses were made and the results showed a large increase in the sucrose in those plants in which the formation of starch had been prevented.

In 1885 I conducted some experiments on a large scale. About two acres of a sorghum field were selected. In each alternate row of the growing cane the seed heads were removed as they appeared. Numerous analyses were made of the canes from both kinds of rows. The result showed most conclusively that no marked increase of sucrose was noticed by reason of the prevention of the deposition of starch. It is far more simple to suppose that the sucrose which we find in sorghum is produced directly by the decomposition of protoplasm in presence of carbonic acid, provoked by the katalytic action of the chlorophyll cell. At any rate there is no sort of evidence that it is ever made from starch and no physiologist has ever invented any hypothetical saccharoplast to account for such a transformation.

This subject of the origin of sucrose is of great interest but I have not yet finished my experimental studies of it and so will not pursue it further at present.

The question now arises is the sucrose of sorghum a plastic material, reserve material, or waste? In respect of plastic material it is sufficient to call attention to the fact that the development of sucrose does not begin in the plant until it is far on the road to maturity. To this it may be objected that its accumulation does not begin until this period, and that what is formed earlier in its history is a really plastic material used in the development of other tissues. Had I time I might show, I think, conclusively, that the presence of the sucrose as a plastic material is not probable. Is it a reserve material? The sucrose which is deposited in the seeds of plants, in tubers like the sugar beet, and in sugar-cane, doubtless is a true reserve material and by its decomposition helps the growth of the succeeding plant. But the sucrose in sorghum seems to have no such function. It can in no way aid the incipient growth of the next plant, for that plant grows from a seed. As far as any use in the economy of the plant is concerned, it appears to be absolutely worthless. It is true that in the case of "suckering," the sucrose in the cane may suffer loss, but "suckering" is not always a natural growth; it is adventitious and is always detrimental to the proper maturity of a plant.

It seems, therefore, that the sucrose in sorghum is purely a waste material—as much so as an alkaloid or a resin.

In the cases where sucrose is a true reserve material, as in seeds, in tubers, and in sugar-cane, we find there is no tendency for it to disappear until the needs of the new plant require it. The sucrose remains, for instance, unchanged in the sugar beet until the new growth begins. The same is true in a higher degree of the sucrose in seeds. The fact, therefore, that in sorghum all traces of sucrose may disappear in a few days shows that its office is radically different.

As a result of my investigations I will say that the development of sucrose in sorghum is an accidental function, or rather an adventitious function. It goes on usually *pari passu* with the formation of the starch in the grain and the content of sucrose in the plant, and its quantity is at a maximum at the time the starch formation is completed. In the sugar-cane the sucrose appears to be not only reserve, but also plastic material. In the upper part of the cane the content of sucrose is much less than in the lower, showing that in the region of most active growth the sucrose may suffer decomposition and help in the formation of proteid. (I wish to add here that the only way in which the plant can use sucrose for

the formation of other bodies or for working it into living tissues is by thus getting it into protoplasm.) On the other hand the content of sucrose in sorghum is sensibly the same in all parts of the cane, being just as great at the top near the place of most rapid starch storage, as it is near the base. It is not strange, therefore, if it be true that the production of sucrose is only the expression of the exuberant vitality of the leaf of the sorghum, that the greatest variations should be met with the content of sucrose. These variations are not confined to different varieties or to different fields but are found in the same variety in different canes growing in the same hill, and which, therefore, have been subjected to precisely the same conditions of culture and weather.

In ten successive analyses of sugar beets made two years ago, I found no greater variation than one per cent. in sucrose. The same was true of ten successive analyses of sugar-canes I made last month, November, 1886. On the other hand, any ten successive analyses of sorghum canes, made last October, will show a variation of six per cent.

I have not the time here to cite all the instances I have noticed which illustrate the principles set forth above. They number hundreds. Without a record of these analyses, however, the fact clearly appears that the chief cause of variation is found in the accidental or adventitious nature of the formation of the sucrose—in other words, its independence of the life history of the plant. When, however, the sucrose has once been formed, as in a mature cane, it is subject to sudden variations. Sudden changes in the weather, severe frosts, followed by warm weather, or simply standing dead ripe, often cause a rapid disappearance of the sucrose. It is first converted into invert sugar and this quickly disappears by fermentation.

When the canes have been cut also, if they be expressed at a temperature of a warm September day, the sucrose is rapidly inverted. This inversion is not due to the action of the acids which the sap contains, but is produced by a special ferment, probably *invertin*, or some similar substance.[4]

These variations in the content of sucrose, are, as I intimated at the beginning, the chief obstacles now in the way of the successful introduction of a sorghum sugar industry into this country. The last one is easily avoided by promptly working the cane as soon as it is cut. The first one can

[4]Ducloux, Compt. rend, 103, p. 881, has shown that sunlight is capable of inverting a solution of sucrose.

only be overcome by the scientific agronomist, aided by the best practical botany and chemistry.

Since sending the above paper I have received the *Revue Scientifique*, of February 5, 1887, containing a notice of the observations of Girard on the production of carbohydrates in plants. This author definitely confirms my statements in respect of the independent formation of sucrose in leaves. The reviewer says:

"Les expériences de M. A. Girard mettent hors de doute que les limbes fabriquent alors des saccharose et des sucres réducteurs."

M. Girard shows the possibility of leaves developing starch from sucrose, but there appears to be no evidence that the reverse of this operation takes place.

Notes on Umbelliferæ of E. United States. II.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE II.)

ANGELICA L.—Fruit strongly flattened dorsally, broadly winged at the commissure: carpel with 5 strong primary ribs, each with a group of strengthening cells,[1] the 2 lateral extended into broad wings, distinct from those of the other carpel, forming a double-winged margin to the fruit: oil-ducts one to several in the intervals or indefinite, 2 to 10 on the commissural side (figs. 14–18).—Stout perennials, with ternately or pinnately compound leaves, large terminal umbels, scanty or no involucre, small many-leaved involucels, and white or greenish flowers.—Incl. *Archangelica* Hoffm., excl. *A. Gmelini* DC.—Archangelica is referred to Angelica by Maximowicz, Bull. Acad., Petersb., 19. 273. The only characters serving to separate Archangelica from Angelica break down. The number of oil-ducts in the intervals, while usually one in Angelica, in Angelica Curtissii may be two, or even three, as well in the dorsal intervals as in the lateral; while in Archangelica hirsuta the oil-ducts may be reduced to one or two in the intervals. The generic relation of neither of these species can be determined by any character drawn from the oil-ducts, and plac-

[1] In January GAZETTE, p. 14, third sentence from bottom, in contrasting the characters of Angelica and Conioselinum, the last clause ("especially conspicuous under the lateral ribs") might be understood to refer to Conioselinum. It refers to Angelica.

ing Angelica Curtissii and Archangelica hirsuta together the other Archangelicas must follow. Also, the adherence of the seed to the pericarp is hardly a usable character, as in Archangelica hirsuta it becomes loose very tardily, and in most (even mature) specimens appears as completely adherent as in Angelica Curtissii. Sometimes the same is true in A. dentata also. Archangelica Gmelini we do not consider a member of Angeliceæ at all.

* Seed adherent to pericarp: oil-ducts one to several in the intervals: uppermost leaves mostly reduced to large inflated petioles.

1. **A. Curtissii** Buckley, Am. Jour. Sci. 1. 45. 173. Smooth: leaves twice ternate or the divisions quinate; leaflets thin, ovate-lanceolate (1 to 3 in. broad), sharply and irregularly toothed: fruit smooth (1½ to 3 lines broad); oil-ducts mostly one in the intervals (sometimes 2 or 3), 2 to 6 on the commissural side (figs. 14, 15).—Along the Alleghanies from Pennsylvania to N. Carolina. Fl. August.

2. **A. hirsuta** Muhl. Cat. 2 ed. 30. Pubescent above: leaves twice pinnately or ternately divided; leaflets thickish, lanceolate to oblong (5 to 10 lines broad), serrate: fruit pubescent (2 lines broad); oil-ducts 3 to 6 in the intervals (sometimes 1 or 2), 6 to 10 on the commissural side (fig. 16).—*Archangelica hirsuta* Torr. & Gray, Fl. 1. 622; Chapman, 164; Gray, Manual, 193. *Angelica triquinata* Nutt. Genera, 1. 186.—Dry ground, New York to Minnesota, and southward to Tennessee and Florida. Fl. July.

* * Seed loose in pericarp: oil-ducts indefinite, somewhat evenly distributed, under the ribs as well as in the intervals: upper petioles not so prominent.

3. **A. dentata.** Slender, smooth: leaves ternate, with long slender petioles and few leaflets, which are small, lanceolate, coarsely toothed: umbels slightly pubescent: fruit smooth or pubescent; oil-ducts about 20, with 8 on the commissural side (fig. 17).—*Archangelica dentata* Chapman, Torr. & Gray, Fl. 1. 622; Flora, 164.—Dry pine barrens, Florida. Fl. July to September.

4. **A. atropurpurea** L. Spec. 251. Very stout, smooth, with dark purple stem: leaves 2 to 3-ternately divided; segments of 5 to 7 leaflets, which are lanceolate to ovate (1 to 1½ in. broad), sharply cut mucronate-serrate: umbels smooth: fruit smooth: ribs larger and with much more conspicuous

groups of strengthening cells: oil-ducts 25 to 30, with 8 to 10 on the commissural side (fig. 18).—*Archangelica atropurpurea* Hoffm. Umbel. 161; Gray, Manual, 193.—Low river-banks, from New England to Pennsylvania, Minnesota, and northward. Fl. June.

CŒLOPLEURUM Ledeb.—Fruit globular-ovoid, round in section, or slightly flattened laterally: carpel with 5 very prominent thick corky primary ribs, about equal and none of them winged, each with a large group of strengthening cells: oil-ducts 1 in each interval, 1 (rarely 2) under each rib, and 2–4 on the commissural side: seed loose in the pericarp, plane or slightly concave on the inner face (figs. 19, 20).—Stout perennial, with 1–3-ternately divided leaves, few-leaved involucre and involucels, and greenish-white flowers. Fl. July.—The genus is well marked by its fruit characters. It clearly differs from the whole group of Angeliceæ in the absence of lateral wings, and in the fruit not being at all dorsally flattened. The flattening, if any, is slightly lateral, as in Ligusticum. From Ligusticum it differs in its very large ribs and single oil-duct in each interval; from Selinum in that it has oil-ducts beneath the ribs as well as in the intervals. It was referred by Bongard to Pleurospermum, but differs in having oil-ducts beneath the ribs, and in the face of the seed being mostly plane or very slightly concave.

1. **C. Gmelini** Ledeb. Fl. Ross. 2. 361. Stem 1–3 ft. high: leaflets ovate, acute, cut-serrate.—*Archangelica Gmelini* DC; Gray, Manual, 193. *A. peregrina* Nutt.—New England and northward, also in the Rocky Mountain region.

ÆTHUSA L.—Fruit ovate-globose, slightly flattened dorsally: carpel with 5 thick sharp primary ribs and no strengthening cells except in very tips of the ridges: oil-ducts one in each interval and two on the commissural side (figs. 21, 22).—Poisonous annuals, with 2 to 3-ternately compound leaves, divisions pinnate, ultimate segments small and many cleft, no involucre, long narrow involucels, and white flowers in July.

1. **Æ. Cynapium** L. A fetid, poisonous European herb, in cultivated grounds, from New England and Pennsylvania to Minnesota.

CONIUM L.—Fruit ovate, flattened laterally: carpel with 5 prominent wavy primary ribs, each with a large

bundle of strengthening cells: oil-ducts none, but a layer of secreting cells next the seed: seed deeply and narrowly concave on the inner face (figs. 23, 24).—Poisonous biennials, with spotted stems, large decompound leaves with lanceolate pinnatified leaflets, narrow-leaved involucres and involucels, and white flowers in July.

1. **C. maculatum** L. A large branching European herb, in waste places throughout the Northern States.

POLYTÆNIA DC.—Fruit obovate to oval, much flattened dorsally: carpel with 5 primary ribs, the dorsal and intermediate small or obscure in the depressed back, the lateral forming broad thick corky wings closely contiguous to those of the other carpel and forming the margin of the fruit: oil-ducts 12 to 18 about the seed (4 to 6 on commissural side) and many scattered through the thick corky pericarp, which also contains 5 small bundles of strengthening cells: seed-section variable, oval or much flattened (figs. 25, 26).—Perennial, mostly glabrous herbs, with twice pinnate leaves (upper opposite and 3-cleft), segments cuneate and incised, no involucre, narrow involucels, and bright yellow flowers in May.

1. **P. Nuttallii** DC. Mem. Umbel. 53. t. 13. Plant 2 to 3 feet high: pedicels and involucels pubescent.—Michigan to Louisiana and westward.

EXPLANATION OF PLATE II.—Fig. 14, Fruit of Angelica Curtissii, × 7. Fig. 15, Section of carpel of same, × 20. Fig. 16, Section of carpel of A. hirsuta, × 20. Fig. 17, Section of carpel of A. dentata, × 20. Fig. 18, Section of carpel of A. atropurpurea, × 20. Fig. 19, Fruit of Cœlopleurum Gmelini, × 7. Fig. 20, Section of carpel of same, × 20. Fig. 21, Fruit of Æthusa Cynapium, × 10. Fig. 22, Section of carpel of same, × 20. Fig. 23, Fruit of Conium maculatum, × 7. Fig. 24, Section of carpel of same × 20. Fig. 25, Fruit of Polytænia Nuttallii. × 3½. Fig. 26, Section of carpel of same. × 20.

BRIEFER ARTICLES.

Carex notes.—*Carex glaucodea* Tuckm., which W. Boott, Esq., has recently referred to C. grisea, has an even, strongly curved style, completely separating it from the latter, and also from C. flaccosperma, which has an even, straight style. "Bulbous thickened" does not accurately describe the style of C. grisea, as it is often merely thickened above the base as in C. oligocarpa. But this character is sufficiently marked to disconnect it from the others mentioned. Judged by external characters only, these three species sometimes closely approach each other, but their styles are permanently different.—E. C. HOWE, *Lansingburg, N. Y.*

Ash in basket work.—In the BOTANICAL GAZETTE, vol. xi, pp. 326-328, is an article on Hierochloa borealis, in which the author describes the use of this grass in basket work. Furthermore he says: "The wood used, which forms the main part of these articles, is white ash, Fraxinus Americana, and red maple, Acer rubrum, called in Maine white maple. These woods they prepare at home, splitting the ash into strips of the requisite thinness and width by means of a machine."

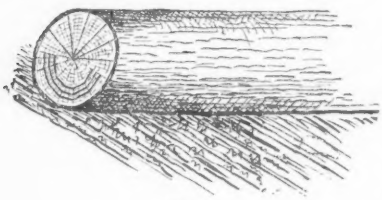


Fig. 1.

In conversation with an old basket maker, in the eastern part of Yates Township, Orleans County, N. Y., I gleaned the following facts relative to a more primitive method of splitting ash than that by machines. This basket maker first splits the ash log into wedge-shaped pieces as represented in the upper half of figure 1. These pieces are again divided into parts along the cross-lines, as seen in the lower half of figure 1. The pieces now obtained are called "bars. In order to separate the bar into strips suitable for his work, the basket maker places the bar on a block and strikes hard blows upon it with a heavy hammer. The blows fall perpendicular to the layers of growth. This causes the layers of wood to slightly separate, much in the same way as a lad in making a whistle, by pounding for a time, loosens the willow bark. In order to still farther separate the layers, the basket maker causes the end of the bar to project about four or six inches from the pounding block, and strikes more hard blows upon the projecting end. This causes the end of the bar to separate in layers, as figure 2 shows. The strips of layers of growth, or "grains" in the basket makers' terminology, can then be readily pulled apart. These strips vary in thickness and are either trimmed by various guages or are themselves split by one of two methods. Thus, the edge of the strip having been split by a knife for a distance of six inches, one of the halves is placed on the floor and the basket maker holds it down with his foot, at the same time pulling on the other split portion. Thus it is divided. Or the basket maker grasps the strip with both hands, near one end, and bends it rapidly between them; then he slips his hands up the strip and repeats the bending, etc., until he has reached the end of the strip. This procedure separates the fibres so that the strip is easily made into two. This basket

Fig. 2.

maker prefers black ash which has been exposed to the wind and sun. The best ash for his purpose is obtained from a wood-lot which is open and dry. Next to this he prefers isolated trees near a forest. He does not use black ash of the "black ash swamps," for, he says, "the grains are too thin and the wood is not as tough."

The structure of the ash determines its mode of splitting under heavy blows. It divides at the lines of demarcation of the annual layers. Here are to be seen, upon microscopic examination, large dotted ducts, whose open mouths are quite evident to the naked eye, in cross section.

The earliest mention of the ash and other trees in this section of Western New York, that I know of, may be found in a handbill issued by Joseph Ellicott, November 26th, 1800, (and quoted in Turner's History of the Holland Purchase), viz: "Those who prefer land timbered with black and white oak, hickory, poplar, chestnut, wild cherry, butternut and dogwood, or the more luxuriant, timbered with basswood, sugar tree, white ash, wild cherry, cucumber tree—a species of magnolia—and black walnut, may be suited."

I am indebted to a botanical friend, Miss L. A. Weld, for the drawings.—CHARLES E. FAIRMAN.

Astringent qualities of Heuchera and Mitella.—It is well known that astringency is a common property in the Saxifrage family, and in the west, *Heuchera hispida* Pursh., *H. cylindrica* Dougl., and *H. parvifolia* Nutt., are well known by the hunters, prospectors and others who lead a wandering life. These plants are all very astringent and are successfully employed in cases of diarrhœa of all degrees of severity. This complaint is very troublesome and all the more so on account of its liability to occur at any time. This is particularly the case in alkali regions where the water one has to drink is so bad as to bring on this sickness in a few hours. Of course no drug stores are at hand, but by a little search one can usually find one or another of the species mentioned, H. parvifolia being the commonest species in Northern Montana. Any one troubled with the complaint mentioned can, by chewing a small portion of the root and swallowing the juice, quickly relieve himself. Or where the dried root is used, some people carrying a supply wherever they go, a decoction is often made, but is very disagreeable to take. The great trouble with alum root is that if one takes only a little too much sudden constipation comes on and has been known to last for days, often causing dangerous symptoms.

We have tried several native roots at different times while far away from human habitations and have found that the root of *Mitella pentandra* Hook. is far superior to alum root. It is milder and slower in its action and besides being mildly astringent possesses a bitter principle which acts as an appetizer, as we have demonstrated to our perfect satisfaction

on several occasions. The last time we employed it was in the case of a young man who had been troubled with diarrhœa for three weeks. During the last week of the period the complaint was coupled with severe indigestion and total loss of appetite. Having nothing at hand to give him we broke off the root from a botanical specimen of Mitella pentandra and divided it into two parts of about ten grains each. He chewed and swallowed one piece on the spot (about 9 A. M.) and ate the remainder at 11 A. M. Before noon he actually complained of great hunger and spoke with evident relish, to our amazement, of what he expected to have for dinner. We saw him again at 2 P. M., and he felt much better, telling us how he had enjoyed his dinner. The next morning we saw him again, and he was well in every respect, having a good appetite and digestion, his bowels being free and regular in their action. Now this man had been sick, and looked sick, for three weeks, yet that little bit of root made him well in less than twenty-four hours. We would not say that such decided results would take place in every instance, but, as mentioned before, we have used the root of this plant on several occasions with beneficial results. By accident we discovered the good quality of the plant in question. It is our custom to taste every root we find new to us, and that is the way we found out. Thinking this might be new to the public, and that the knowledge of it might be of practical value to others, we submit these remarks to the readers of the GAZETTE.—F. W. ANDERSON, *Great Falls, Montana.*

Celery Leaf Blight (*Cercospora Apii* Fres.)—This disease annually destroys about one half of the celery planted in this section; last year (1886) the loss occasioned by the parasite was not so great as in former years, owing, no doubt, to the dry weather which prevailed in this section. Frequent showers and heavy dews followed by hot sunshine favors the growth of the fungus. The fungus usually appears in this section about the first of July, and at the approach of cool weather, which usually comes on in September, the fungus gradually disappears. When fresh the conidia germinate readily (in three hours) by sending out a delicate, colorless thread from each cell. So long as the celery leaves are kept dry but few of the conidia germinate, but if the leaves are frequently moistened the fungus quickly destroys them. Celery protected from the direct rays of the sun, either by natural means, as planting under trees, or by screens made for the purpose, is rarely attacked by the parasite.

On September 26, 1886, several healthy celery plants that were growing in the open air were lifted and planted in the green-house. About one week later sowings of the conidia of C. Apii were made upon the leaves of several plants. Fifteen days later the leaves where the sowings had been made showed the pale green pustules which always appear just before the hyphæ and conidia become visible. Owing to the cool weather which came on about the time the pustules made their appearance, the

fungus made no further progress, except several spots which showed the brownish hyphæ, but no conidia. The plants upon which no sowings were made remained healthy. If the experiment had been made earlier in the season the development of the fungus would have been more rapid. A form of C. Apii is quite common on Pastinaca, but is quite distinct from C. Apii on cultivated celery. In the *Journal of Mycology* (vol. I, p. 37), the form on Pastinaca is included under *C. Apii* Fres. Mr. Ellis thinks, however, that the form on Pastinaca might be called *C. Pastinacæ* with propriety, as distinct from *C. Apii* Fres.—B. T. GALLOWAY, *Columbia, Mo.*

An American Papaver.—Last summer Mr. John Spence, a florist of Santa Barbara, collected many plants in the high mountain regions of Santa Barbara County, which he submitted to me for examination. Among other novelties were the beautiful orange-colored blossoms of a Papaver. In the absence of root or foliage, it was not easy to tell whether it was P. Rhœas of Europe or something new; but, judging from the location in which it was obtained, I suspected it might be something new, and sent it to Dr. Gray. On a visit to the same locality later in the season, Mr. Spence obtained ripe seed, and succeeded in raising perfect plants, specimens of which he has sent to Dr. Gray, who decides that it is a new species. Being the first American representative of the genus, Dr. Gray very appropriately christened it *Papaver Californica*. Mr. Spence says the plant is found in quantity where the ground had been burned over the previous season, and that the large masses of brilliant orange flowers could not fail to attract attention. The same plant was found last year, by other individuals, in two different localities in the Santa Ynez mountains, and under the same conditions, on ground that had been burned over the previous year; but we have no report of its having been collected before last year.—MRS. R. F. BINGHAM.

Vermicularia phlogina Fairman (n. sp.)—Perithecia very delicate, minute, superficial, sparingly clothed with bristles of varying length, subhyaline above, darker below, continuously or sparingly septate, 60–100 μ long and 5–7 μ thick, tips (especially the longer ones) obtuse: sporules oblong, fusoid, hyaline, slightly curved, endochrome at length imperfectly divided in the middle, 15–20$\times$2½–3 μ.—Differs from *V. Coptina* Pk. in its smaller, paler perithecia and different bristles.

On leaves of Phlox divaricata. Ridgeway, Orleans County, New York, July, 1886.

This Vermicularia occurs on the phlox leaves, (generally after flowering of the host), often mixed with a Cladosporium (*C. epiphyllum* Nees?) sometimes pure, and at times suspected leaves have only the Cladosporium present.—CHARLES E. FAIRMAN, *Lyndonville, New York.*

EDITORIAL.

ONE THING is especially true of American botany—it is vigorous and progressive. The evidences of accelerating growth may reasonably support hopes of a future development as profound, even if not as massive, as Germany now possesses. We are of a mind with our German correspondent (whose views on this and other points carry all the more weight by being taken from a letter not written for publication), that time will bring us college faculties in botany, with all implied improvements and accompaniments, where we now have isolated teachers. It is, indeed, quite possible to establish a few laboratories and lecture rooms in emulation of the best the world knows, if men of erudition and indomitable energy are willing to devote themselves to the work, and can secure the backing of sufficiently large and wealthy institutions, yet to see the science acknowledged as an essential part of a general education, which is now true in a limited sense only, there must exist the conviction in the public mind that it is of greater importance than other studies which it displaces. Public attention is much more directed toward the useful at the present time than what is simply interesting. It will be good policy, therefore, for botanists to pay regard to those subjects which affect the thought and welfare of the people. In passing this way the dangerous ground of superficiality must be sedulously avoided, for our plea is not for popularity at the expense of science, but for the advancement of science by the aid of the good will of the people. Let the botany, presented by botanists, take hold of problems of human welfare and philosophy in a masterly way, and the public will not fail to show appreciation by lending its support to the advancement of the science as a whole.

OPEN LETTERS.

Anatomical Botany.

I am half inclined to take exceptions to an editorial in the GAZETTE for November, 1885, *a propos* of physiologists *versus* systematists. It seems to me that you rather ignored another group of workers, for want of a better name, anatomists. There is an immense amount of structural work, in fact, all morphological work, embryology, etc., which, to my mind, can not properly be brought under the head of physiology, and which certainly does not belong to the domain of systematic botany. Now it seems to me that just here is a great field open for our American botanists, in which very little expensive apparatus, aside from the microscope, is required. It is not all of it easy work, but certainly there is enough to be done to satisfy the most ardent of those same young enthusiasts of whom you speak, who set out to reorganize the whole science.

Bonn. DOUGLAS H. CAMPBELL.

Ouvirandra fenestralis.

In the January number of the BOTANICAL GAZETTE the fact is mentioned that it is very difficult to keep Ouvirandra fenestralis free from algæ. This seems to be the only real difficulty in cultivating this most interesting plant, and it may be of interest to your readers that it has been overcome in the Botanic Garden at Breslau (Germany) by putting some specimens of Planorbis corneus into the tank where that plant was growing. This snail cleans Ouvirandra thoroughly without injuring it. I do not know whether Planorbis corneus occurs in America, but any other species will probably do quite as well. English cultivators recommend keeping Ouvirandra in the shade to prevent the luxuriant growth of algæ on it. (cf. Regel's *Gartenflora*, 1886, pp 308 and 687).

Botanic Garden, Oxford, England. DR. S. SCHÖNLAND.

Rendering herbarium specimens pliable.

A year or more ago I received a package of plants from a botanical correspondent which, though otherwise very fine, were extremely brittle, and therefore liable to be injured by handling. It happily occurred to me to try whether perhaps glycerine would render the specimens more pliable and so to a portion of my poisoning mixture (the ordinary one of 1 oz. corrosive sublimate to a quart of methylic alcohol) I added glycerine in the proportion of 4 ozs. to the quart. On treating the plants with this solution they were very much improved and could be handled without danger of undue breakage. Since then I have used no other mixture, only I have gradually improved it until now my poisoning solution is made up as follows: Alcohol, 26 fl. oz.; corrosive sublimate, 1 oz.; mix and dissolve, then add 6 fl. oz. glycerine. Plants poisoned by this solution are not only well preserved, but are also much less liable to be damaged by frequent handling. F. T. ASCHMAN.

Sharon, Pa.

German and American Botanists.

One is very soon impressed with the different standing of science in Germany and America, when he is here. I wish all our workers, and especially the young men, might come and learn something of the thoroughness, the patience and enthusiasm of the Germans. It would have a wonderful effect upon our future scientific development. The amount of original work done here is enormous. No professor of natural science is content with the mere teaching of his specialty, but strives to add something to the knowledge which he already has. Indeed, no man can long hold his place who does not do original work. The result is keen interest and competition, and a splendid scientific literature. I will not say our American scientists are at fault, because they do not do likewise, for they are overloaded with routine work, and have no time outside of college duties. They are not yet specialists, because few of our American institutions are yet broad enough to support a botanical or chemical *faculty*. But all this will come also in America in due time.

Göttingen, Germany. WINTHROP E. STONE.

NOTES AND NEWS.

THE *American Naturalist* will hereafter be published by J. B. Lippincott & Co., of Philadelphia.

PROFESSOR JOHN M. COULTER was elected president of the Indiana Academy of Science for 1887.

IN THE GAZETTE for December, 1886, page 330, in "Explanation of Plate XI," Carex gracillima should read Carex debilis.

A PAPER on North American Geraniaceæ has been presented to the Boston Society of Natural History by Dr. Wm. Trelease.

THROUGH THE kindness of a member of the corporation, the botanical laboratory of Brown University is now equipped with six of Beck's "Star" microscopes.

IN THE GAZETTE for November, 1886, there is a mistake in Professor Scribner's plate on the Black Rot. In figure 8 the *µ* should be *mm*. The mistake was made in copying the figure.

AN INTERESTING fungus, *Boletus decipiens* B. & C., has been found in Niagara County, N. Y., by Dr. Charles E. Fairman. Hitherto it has only been collected in the southern states.

MR. PHILIP L. COBB, of Cleveland, O., writes that Viola hastata and a white flowered variety of Cnicus arvensis occur east of that city, and that Lactuca Scariola is common in and about the city.

M. ALPH. DECANDOLLE has just distributed a paper, from the *Archives des Sciences Physiques et Naturelles*, on the botanical origin of certain cultivated plants and the probable causes of the extinction of certain species.

EXPERIMENTS made by G. H. Whitcher (*Agricultural Science*, vol. I p. 30) appear to show that the aerial roots of corn (maize), which are produced most abundantly at the time of flowering, give off ammonia during their growth.

THE *Journal of Botany* (February) contains the description (with plate) of a fine new hepatic from Killarney, by Richard Spruce. It is called Lejeunea Holtii. A list of Jamaica mosses and Hepatics is also given by Henry Boswell.

SOCIETATUM LITTERÆ is the title of a small monthly in which Friedländer & Sohn, of Berlin, propose to give a bibliographic list of papers in natural history published by the societies of the world. It is 2 marks 50 pfg. a year, or about 60 cents.

THE *Bulletin of the Torrey Botanical Club* for February contains "Notes on Diatoms," by C. Henry Kain; "Note on the Inflorescence of Camellia Japonica," by E. E. Sterns, and "A Method of Drying Plants with Little Loss of Color," by Charles E. Smith.

IT IS VERY much desired to obtain copies of the January number of 1886 (Vol. XI, No. 1.) Any botanist having a duplicate copy would confer a great favor by sending it to the BOTANICAL GAZETTE, Crawfordsville, Ind. The regular price for single copies will be paid.

THE GAZETTE has received much commendation for its very full index of Vol. XI, issued with the December number of that year. It is proposed to make all the information contained in the GAZETTE as available as possible and exhaustive indexing will hereafter be one of its features.

At a recent meeting of the Philadelphia Academy, Miss Helen C. De S. Abbott announced the discovery of hæmatoxylin in the bark of Saraca Indica. It is another genus of the same order to which Hæmatoxylin Campechianum belongs, the only plant heretofore known to yield hæmatoxylin.

Lorenzo G. Yates, of Santa Barbara, California, has published a list of Hawaiian ferns, with notes of locality, etc. Of the 129 species, ten are found in North America, five of which are Californian. Mr. Yates has also in preparation a similar list of the ferns of Ceylon, as well as a list of all known ferns, with synonymy, habitat, etc.

Prof. F. L. Sargent gives in the *American Monthly Mic. Journal* for February an interesting paper "On the Schwendener Theory of the Constitution of Lichens." In this connection we must congratulate this journal upon its improved appearance. The abandonment of the two-column page is a decided change for the better.

Mr. Henry Willey, of New Bedford, Mass., is offering for sale his large collection of lichens and also his library. It is undoubtedly the most complete in this country after that of the late Professor Tuckerman. It would give any student of lichens in this country an unsurpassed opportunity for good work. The collection is valued at $2,000.

Most of the ornamental indigenous plants of the United States are kept for sale in small or large lots by Edward Gillett, of Southwick, Mass., also the seeds of many kinds. His annual catalogue for 1887 makes the tenth issue, and it is pleasant to note that the commercial demand shows an increased appreciation of native wild flowers and ferns.

The "Botanical Society of Western Pennsylvania" was organized in Pittsburgh, Pa., on October 21st, 1886, with twenty-five charter members from that city and vicinity. Prof. B. H. Patterson was elected president, and Dr. A. Pettit, secretary of the new society. Monthly meetings are held, preparatory to active field work during the coming season.

The Columbus (Ohio) Horticultural Society has published a very interesting volume of proceedings for 1886. With such botanists as Professors Townshend, Lazenby and Devol at work the botanical activity of the state is reported as increasing. The only criticism to be made upon this report is its sad lack of continuous pagination. The secretary's address is W. S. Devol, Columbus, O.

A synopsis of Tillandsiæ has been begun by J. G. Baker in the February *Journal of Botany*. The suborder is in great confusion and Dr. Baker's work will be most acceptable to botanists. It contains six genera, separated into two groups by the coalescence of petals into a tube or not. In the present paper the genus Sodiroa (with three species, one of them new) is considered and two species (out of eleven) of the genus Caraguata.

The Journal of the Elisha Mitchell Scientific Society of North Carolina for the year 1885–6 shows a commendable activity in the scientific circles of that state. This publication, of about one hundred and fifty pages, contains a great variety of papers, two of which are of great botanical interest, viz.: "A Sketch of the Life and Scientific Work of L. D. von Schweinitz," with portrait, seventeen pages, containing also complete bibliography; and the "Wilmington Flora," sixty pages, by Dr. T. F. Wood and Gerald McCarthy. The latter is a full catalogue of 1,202 species and varieties, representing 527 genera and 129 orders of phanerogams. The secretary's address is F. P. Venable, Chapel Hill, N. C.

THE LAST NUMBER (December) of *Drugs and Medicines* has just come to hand. It treats chiefly of Lobelia inflata. The drawings of the microscopic structure of various parts are unusually bad—in fact, not up to the average of college student's work. The illustrations of microscopic structure have never been on a par with the other illustrations. The editors of this excellent quarterly might profitably seek to improve the work in this direction.

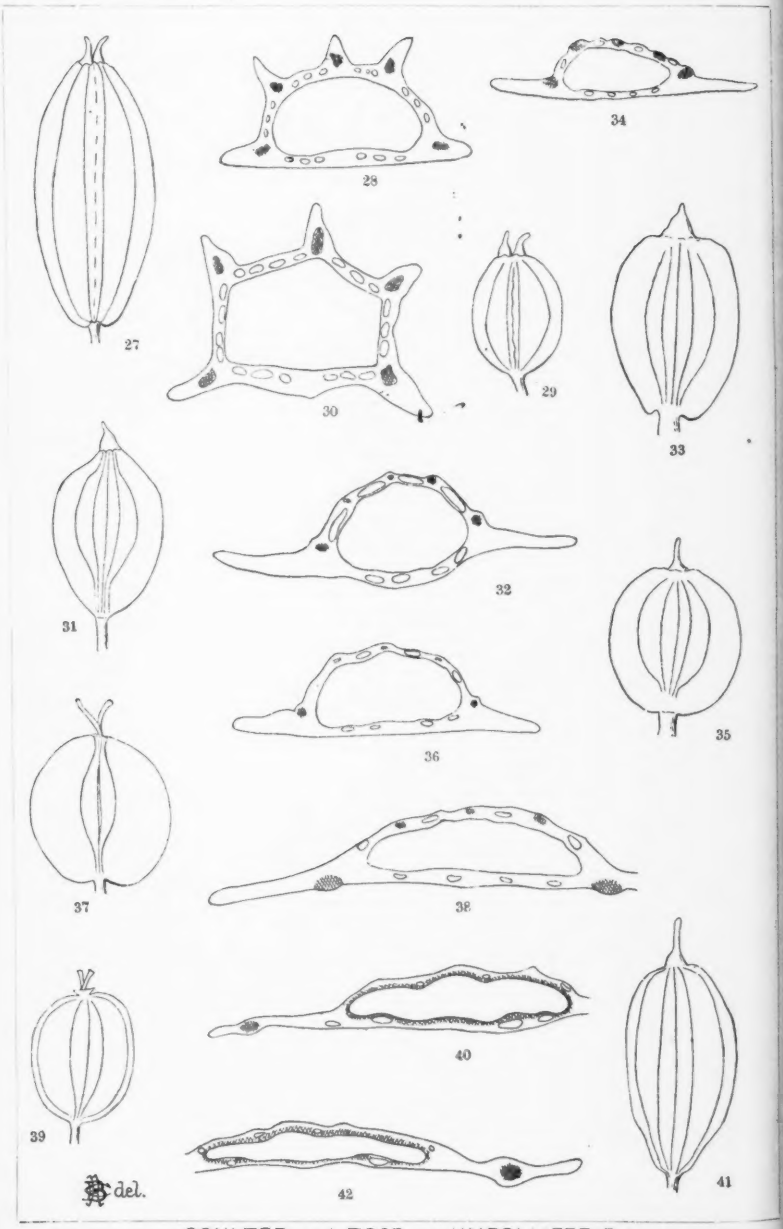
DR. H. W. WILEY, of the Agricultural Department, has just distributed as Bulletin 14, the record of the recent experiments at Fort Scott, Kan., in the manufacture of sugar from sorghum and sugar canes. The results are very interesting from a scientific point of view, and suggest many problems for future investigation, but the "practical" result is best stated in Dr. Wiley's own words:

> "It must be confessed that the chief object of this last series of experiments, viz.: to place the industry where private capital would see its way clear to its extension, has not been attained."

THE ACCOUNT of larval entomophthora, E. Phytonomi on Phytonomus punctatus, given in the January number for 1886, is supplemented by Mr. Arthur in his recent report to the New York Agricultural Experiment Station. It is found that the germination of the spores on the surface of water differs widely from germination under water. Instead of forming mycelium they put out short hyphæ of definite length, on each of which is born a single minute spore, as shown in the accompanying figure (× 200). Such spores are well adapted by their minuteness for long distance transportation through the air.

THE INDIANA Academy of Science is a young but very vigorous organization. After a meeting to organize, the first annual meeting was held at Indianapolis during the holidays. Over 100 persons, of various scientific taste and attainment, joined, and among them the botanists were well represented. Among the papers presented, those of botanical interest were "Origin of the Indiana Flora," John M. Coulter; "Mildews of Indiana," J. N. Rose; "Chlorophyll Bands of Spirogyra," Stanley Coulter; "Additions to the Indiana Flora," Geo. C. Hubbard. In addition to these, Prof. Chas. R. Barnes gave directions for the collection of mosses. Prof. Stanley Coulter's paper brought out certain peculiarities in the action of the young bands of Spirogyra under shock and will shortly be prepared for the readers of the GAZETTE.

DR. E. LOEW has published in the *Jahrbuch* of the Berlin Botanic Gardens the results of his extensive experiments upon the reciprocal relations of showy flowers and insects. The work was intended to supplement that of Hermann Müller. Müller's investigations were conducted with the native flora of Germany. Loew, however, substituted an artificial assemblage of flowers from various parts of the world, and tried to ascertain how far the insects would make the selections indicated by Müller. In general Müller's conclusions were corroborated, but the bee tribe often made different selections when foreign plants were brought into competition with indigenous ones. Of oriental flowers they preferred the deeper-colored ones, while the lighter-colored Compositæ among American plants were preferred.



COULTER and ROSE on UMBELLIFERÆ.